Performance Test of CI Engine with Different Vegetable Oil as a Fuel

Mr.Paresh K. Kasundra [1] *, Prof. Ashish V. Gohil[2],

[1] M.E.[Mechanical (Cryogenic)], Assistant Professor-Mechanical Engineering Department
B.H.Gardi College of Engineering & Technology, Gardi Vidyapith

[2] Ph.d.[Production engineering], Associate Professor & H.O.D -Production Engineering Department
L.E. College, Morbi.

Abstract-

Today, the diesel engine is still capable of running on "biodiesel" fuel, which can be produced from a variety of renewable sources, including soyabean oil, canola oil, sunflower oil, cottonseed oil, and animal fats. These sources can be obtained from agricultural feedstocks or by recycling used oil such as cooking grease. Biodiesel is usable in it's pure form known as "neat biodiesel" or B100. In addition, it is available in various blends with petrodiesel, the most common of which is known as B20(20 percent biodiesel and 80 percent petrodiesel).it is also used in smaller percentage as a lubricating fuel additives.

Copious resource of vegetable oil in India and its ease of translation to biodiesel help to save large expenses done on import of petroleum products and monetary growth of country. Biodiesel also generates enormous rural employment and degraded lands can be restored due to plantation of oil plants which help in reducing greenhouse gasses. in this paper we discuss & compare different performance parameters of C.I. engine with different vegetable oil as a fuel.

Key word: - biodiesel, vegetable oil, diesel engine performance.

I. Introduction

1. Diesel Engine Performance With Vegetable Oils

Now as investigative effort is made to address the performance characteristics of vegetable oils fuels when used in a diesel engine. The criteria behind selection of a test engine is that it should represent engines currently in wide use in agriculture and industrial equipment and engines that are expected to be most sensitive to fuel properties. Hence engine used by Barsic and Humke in both their experiments was a single cylinder naturally aspirated DI engine. Engine performance is influenced by basic difference between diesel fuel and vegetable oil such as calorific value, viscosity, density and molecular oxygen content. Higher densities causes an increase in observed mass flow of fuel at a given injection pump settings. And the fuel flow also increases as internal pump leakages reduce due to high viscosity. Engine performance at maximum fuel delivery, equal energy delivery and at part load is discussed below, the fuel used are Sunflower oil, Peanut oil and Soya bean oil [1,6,7,8].

2. Engine Performance At Equal Energy Delivery And Part Load

Although performance of an unaltered engine with vegetable oil fuel is a primary consideration of the user, the engine performance analyses can only be made by equal energy delivery as it best identifies the basic consumption efficiency. Equal energy delivery means supplying equal amount of energy from both vegetable oil and diesel fuel. Hence some engine performance comparisons for different fuels were made at equal fuel energy rates.[3,4,5,8]

- **Fuel Flow Rates**

It was observed and can be seen in Fig 2.1 that fuel mass flow rate increased with greater fraction of vegetable oils in fuel, lower calorific value of vegetable oils than diesel resulted in constant input of energy.

- **Indicated Power**

At full load equal energy input levels, the indicated power differences were slight when all of the fuel combinations were compared as can be seen in Fig 2.2. At most medium load equal energy input operating point, there were slight power output difference among the fuels tested. Similar trends were observed for light load equal energy input tests.

- **Indicated Thermal Specific Fuel Consumption**

Because of lower heating values of vegetable oils it has been observed that values of ISFC were higher with vegetable oils then with diesel fuel.

- **Thermal Efficiency**

Because of calorific value difference, indicated thermal efficiency is a more relevant parameter than ISFC for assessing the engine's capability to burn the vegetable oil efficiently. It was observed by Barsic and Humke that thermal efficiency generally decreases with increasing percentage of vegetable oil [6,7].

- **Exhaust temperature**

Increases in exhaust temperatures are also an indicative of lower engine performance because the lower heat release rates and retarded heat release associated with lower thermal efficiency contribute to higher exhaust temperatures. Fig 2.3 gives trends for exhaust temperature verses percentage of vegetable oil. These trends are consistent with lower power and lower thermal efficiency trends of vegetable oils.

Similar trends are observed if engine is run on part load. Fig 2.4 shows mass fuel flow rates and engine power output as a function of fuel energy input (part load data) at 2200 rpm for crude and degummed crude soyabean oil as compared to diesel fuel [7].

Fig 2.5 shows comparison of indicated specific fuel consumption, indicated thermal efficiency, and exhaust gas temperature as a function of energy input for crude and degummed crude soyabean oil and diesel fuel [7].

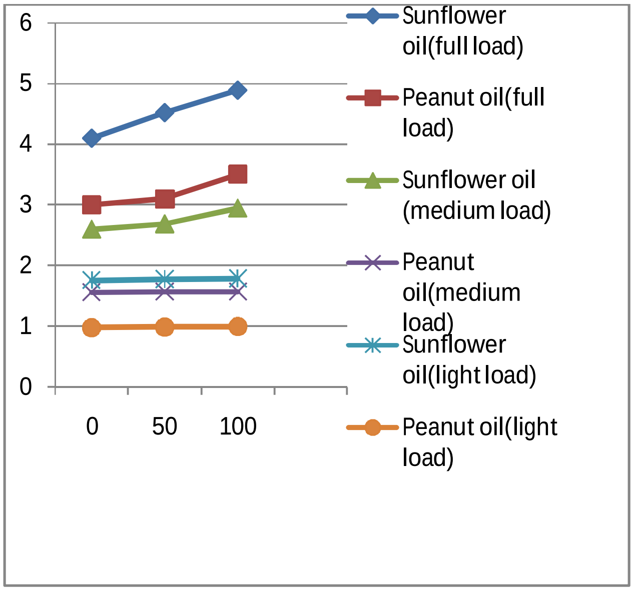


Fig.2.1 Effect on Mass Flow Rate(kg/h) with Change in Percentage of Vegetable Oil [6]

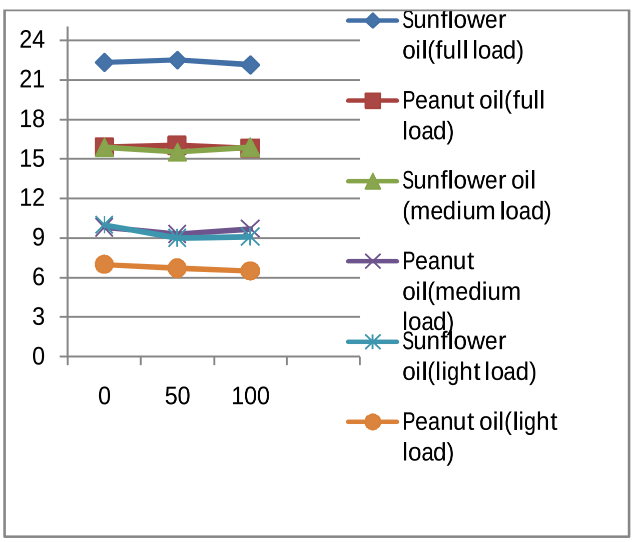


Fig 2.2 Variations in Indicated Power(Kw) at Equal Energy Input [6]

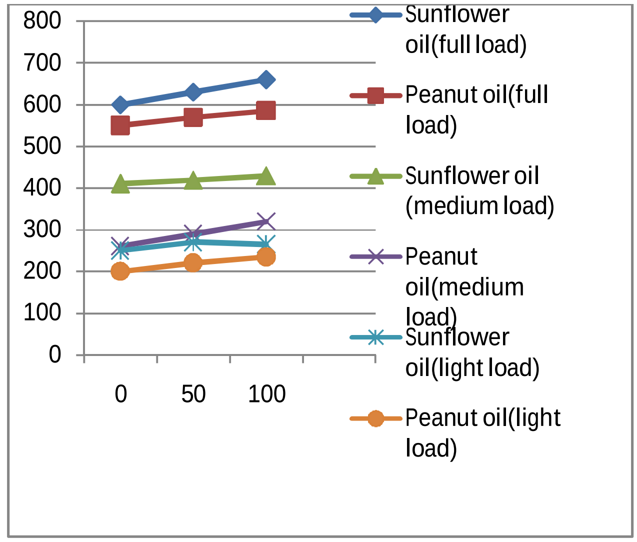
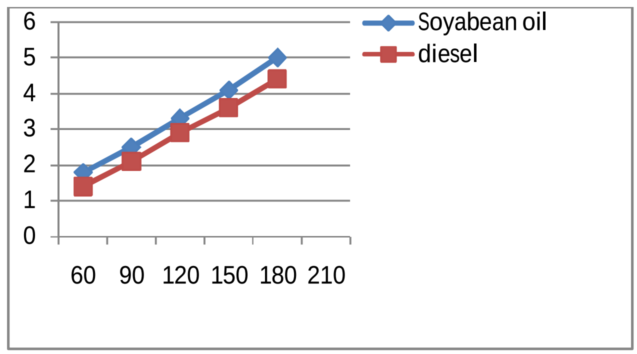


Fig. 2.3 Exhaust Temperature(°C) verses Percentage of Vegetable Oil [6]



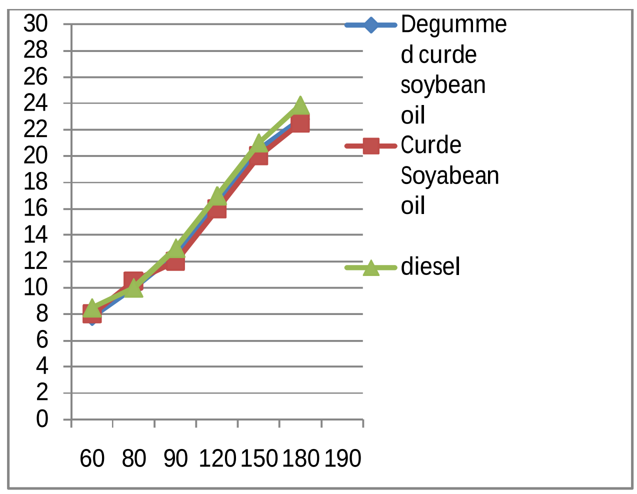


Fig.2.4 Mass Fuel Flow Rates(kg/h) and Engine Power Output(kw) at Part Load [2,7]

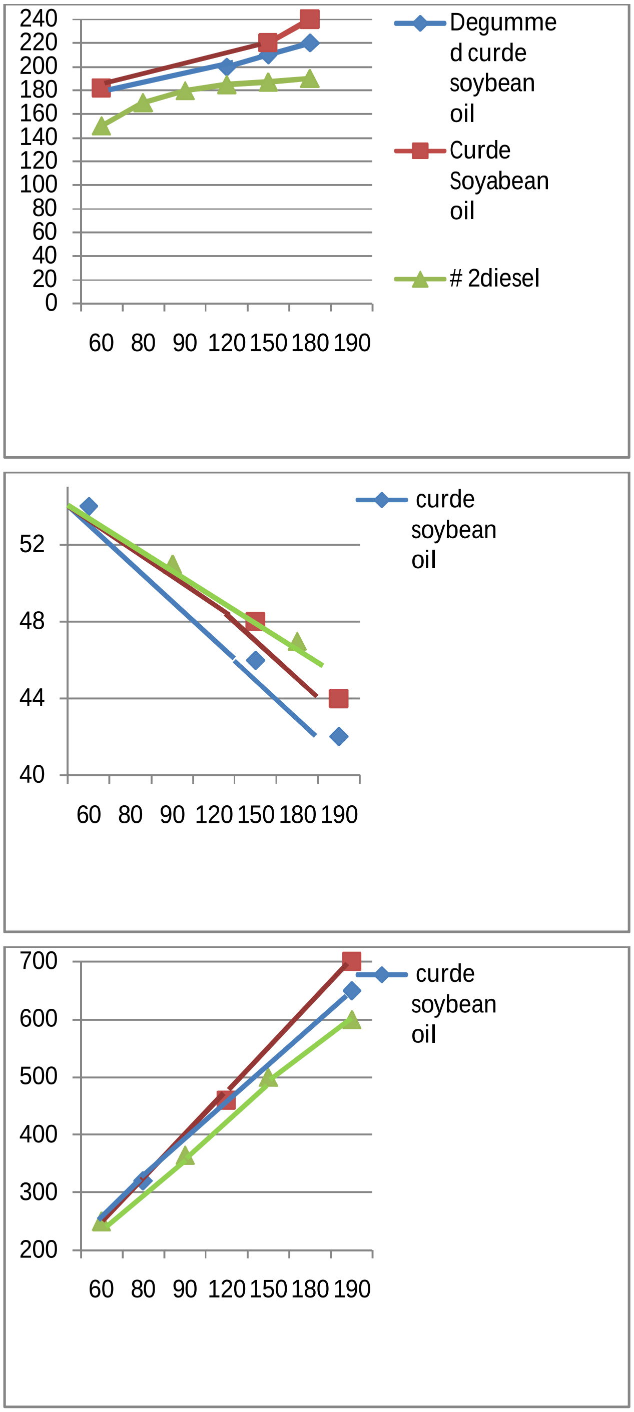


Fig.2.5 Indicated Specific Fuel Consumption(kg/h), Indicated Thermal Efficiency(%), and Exhaust Gas Temperature(°C) at Part Load [2,7]

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